NOTES ON XANTHOXYLUM & FAGARA IN CHINA *

JOHN R. REEDER & SHUH-YUEN CHEO

With two plates

ONE OF THE PROBLEMS in the Rutaceae concerns *Xanthoxylum sens. lat.* The genus was first described by Linnaeus in Sp. Pl. 270. 1753. Later (in Syst. Nat. ed. 10, **2**: 897. 1759) he described *Fagara* which he characterized as having both sepals and petals. *Xanthoxylum* (listed on page 1290 of the same work) differs in having only a single perianth whorl. In vegetative characters plants of both genera are very similar. Subsequent authors have failed to agree as to whether one or two genera are represented in this complex. If it were merely a matter of presence or absence of a perianth whorl, then the question is one of personal opinion as to whether such a difference is generic. A more important consideration, it seems to us, is one of the homologies of the perianth of *Xanthoxylum*, i.e. whether it is calyx or corolla. In the absence of anatomical or other concrete evidence it is, perhaps, of some value to consider the arrangement of the floral parts. In *Fagara* the sepals, petals, and stamens are in alternation and in *Xanthoxylum* the perianth divisions alternate with the stamens. It seems to be more common for petals to be lost before sepals in phylogeny and on that basis the perianth of *Xanthoxylum* is calyx. If this be true, the genus could not be derived from *Fagara* since in that

* *Zanthoxylum* L. (Sp. Pl. 270. 1753) was based upon *Z. Clava-herculis* and *Z. trifoliatum* (=*Acanthopanax trifoliatus* (L.) Merr.). Since the latter species is a member of the Araliaceae, the type of the genus is then *Z. Clava-herculis* which has both sepals and petals and is a member of the genus *Fagara* established by Linnaeus (Syst. Nat. ed. 10, 2: 897. 1759) and amplified by Engler (Nat. Pflanzenfam. 3(4): 115. 1896). Rehder (Jour. Arnold Arb. 26: 71–73. 1945) has pointed out a further complication, namely that Duhamel (Traite Arb. Arbust. 1: 229, *pl.* 97. 1755) published the generic name *Fagara* with a description and figure. He states that the perianth is single and that his plant came from Canada. There seems little doubt that his plant was the species later described as *Xanthoxylum americanum* Miller (Gard. Dict. ed. 8. 1768). The publication of *Fagara* Duhamel antedates by four years *Fagara* L. and according to Article 61 of the International Rules this latter must be rejected. Thus the oldest valid name for the genus all post-Linnaean authors have known as *Zanthoxylum* is *Fagara* Duhamel; for *Fagara* L. we must substitute *Zanthoxylum* L. since this latter genus was based upon *Z. Clava-herculis* which has a double perianth.

If, like Rehder, one believes that only one genus is represented here there is no problem. For those who would recognize both genera, however, strict application of the Rules would necessitate essentially a complete reversal in the application of the names as now used, requiring a wholesale transfer of names in both genera. Accordingly Reeder and Cowan have proposed for consideration by the International Botanical Congress that *Xanthoxylum* Miller (type: *X. americanum*) be conserved against *Zanthoxylum* L., and that *Fagara* L. (type: *F. Pterota*) be conserved against *Fagara* Duhamel. In the present paper the names have been used in this sense in anticipation of the adoption of the above proposal.

genus the stamens are opposite the sepals while in *Xanthoxylum* they are alternate with them. On the other hand, if the perianth divisions in *Xanthoxylum* represent petals the arrangement is the same in the two genera.

Engler (in Nat. Pflanzenfam. 3(4): 115. 1896; ed. 2, 19a: 215–216. 1931) apparently considered that the perianth of *Xanthoxylum* must represent calyx for he states that "after long deliberation" he has decided to recognize both genera. He goes on to say, "the flowers of the true *Xanthoxyla* appear to be, with respect to the perianth parts, a very unique type which does not occur otherwise in the family and which cannot be derived from flowers of the Fagara type." *

After studying numerous specimens in this complex, it is our feeling that both these genera are worthy of recognition. Although there are no striking vegetative differences, flowering specimens are quite distinct. Accordingly we are accepting both *Xanthoxylum* and *Fagara,* an interpretation which is, we believe, in harmony with that of most modern students of the group.

The present paper includes the descriptions of two new species and one variety which appear to be new and in addition five new combinations are proposed.

In connection with this study specimens have been seen from the Arnold Arboretum (A), the New York Botanical Garden (NY), and the United States National Herbarium (US), in addition to those in the Herbarium of Yale University (YU). The writers are indebted to the Directors and Curators of institutions who have generously loaned material for this study.

Fagara robiginosa sp. nov.

Arbor 8–9 m. alta; ramis teretibus levibus haud aculeatis, ramulis juvenilibus circiter 2 mm. diametro dense brunneo-tomentosis demum glabratis; gemmis circiter 2 mm. longis ut ramulis tomentosis; foliis deciduis trifoliolatis petiolo 1.5–4 cm. longo incluso 10–20 cm. longis; petiolo petiolisque ut ramulis gemmisque brunneo-tomentosis; foliolis brevissime petiolulatis vel fere sessilibus, laminis in sicco fusco-olivaceis, chartaceis, supra nitidis utrinque glabris sed punctis parvis praeditis, lanceolatis vel elliptico-lanceolatis 5–12 cm. longis 2–4 cm. latis, basi cuneatis et in petiolulum decurrentibus, apice acuminatis, margine leviter crenatis, sinibus glanduliferis 3–5 per centimetrum, costa supra subplana, subtus valde prominente et leviter pubescente, nervis lateralibus principalibus utrinsecus 8–12 adscendentibus supra subplanis, subtus valde elevatis, marginem versus anastomosantibus, rete venularum intricato copioso utrinque prominulo; inflorescentiis terminalibus paniculatis 2–5 cm. longis 1–3 cm. latis, pedunculo 1–2 cm. longo rhachi pedicellisque dense brunneo-tomentosis, pedicellis teretibus circiter 3–7 mm. longis; fructibus immaturis subglobosis rugosis ad 5 mm. diametro, juvenilibus

* Translation from the German of Engler, loc. cit.

dense mox sparsim brunneo-tomentosis, carpellis fere 2, stylo circiter 1 mm. longo, stigmate capitato, sepalis 5, circiter 0.5 mm. longis, floribus ceterum ignotis.

YUNNAN: Ping-pien District, *H. T. Tsai 62186* (A) (tree about 8 meters tall in woods; fruit immature); *62193* (A, TYPE) June 3, 1934 (tree about 9 meters tall in woods, 1 ft. D.B.H.).

This species seems most closely related to *Fagara dimorphophylla* (Hemsl.) Engler in that the branchlets bear the same types of buds and indument. The hairs on this latter species are, however, more sparse and usually light brown or gray, while on *F. robiginosa* the indument is dense and rusty brown in color. The leaves of the new species are quite different being thin and having the margins only weakly crenate, while those of *F. dimorphophylla* are thick and coriaceous and the margins are usually prominently crenate to bluntly serrate.

No flowering specimens were available to us, both the collections cited being in young fruit. We are placing the new species in *Fagara* since small persistent sepals are evident and alternating with them are scars which apparently represent points where petals have fallen.

Fagara dissita (Hemsl.) Engler var. **hispida** var. nov.

A typo differt rhachibus petiolisque dense (non sparse) aculeis recurvis armatis; ramulis crassis densissime spinosis spinis tenuibus rectis.

SZECHUAN: Omei District, *S. S. Chien 5566* (A); Omei Shan, alt. 1500 m., *W. P. Fang 3111* (A, TYPE; NY) August 17, 1928; without precise locality, *F. T. Wang 23269* (A).

Differs from the species in its somewhat longer leaves in which the rachis and petiole are much more densely clothed with recurved prickles, and in the very densely prickled branchlets. The prickles of the branchlets are slender, straight, and up to 8 mm. long.

The following three species prove, upon examination of the flowers, to belong to the genus *Fagara*. The appropriate combinations are accordingly made below.

Fagara mollis (Rehder) comb. nov.

Xanthoxylum molle Rehder apud Rehder & Wilson in Jour. Arnold Arb. **8:** 150. 1927.

Fagara oxyphylla (Edgew.) comb. nov.

Xanthoxylum oxyphyllum Edgew. in Trans. Linn. Soc. **20:** 42. 1846.

Fagara rhetsoides (Drake) comb. nov.

Xanthoxylum rhetsoides Drake in Jour. de Bot. **6:** 275. 1892.
Evodia odorata Léveillé in Repert. Sp. Nov. **9:** 458. 1911.
Xanthoxylum odoratum (Léveillé) Léveillé in Repert. Sp. Nov. **13:** 266. 1914.
Fagara gigantea Hand.-Mzt. in Anzeig. Akad. Wiss. Wien Math.-Naturw. Kl. **58:** 64. 1921.
Xanthoxylum giganteum (Hand.-Mzt.) Rehder apud Rehder & Wilson in Jour. Arnold Arb. **8:** 151. 1927.
Fagara odorata (Léveillé) Hand.-Mzt., Symbolae Sinicae **7:** 623. 1933.

The remainder of this paper is concerned with *Xanthoxylum sensu strictiore*. This is *Xanthoxylum* sensu Engler (loc. cit.) and comprises that part of the Xanthoxylum-Fagara complex in which the flowers bear only a single perianth whorl.

Xanthoxylum arenosum sp. nov.

Frutex sparsim aculeatus, ramis juventute subteretibus sparsim puberulis demum glabratis, aculeis stipularibus complanatis vel subteretibus circiter 1–2 mm. longis, basim versus valde dilatatis; foliis deciduis trifoliolatis petiolo 2–5 cm. longo incluso 10–20 cm. longis, petiolis glabris anguste alatis basim versus canaliculatis, foliolis brevissime petiolulatis vel fere sessilibus, laminis chartaceis vel subcoriaceis, oblongis vel ellipticis 5–10 cm. longis 3–5 cm. latis, in sicco supra fusco-viridibus, subtus pallidioribus, apice obtusis vel acutis saepe mucronatis, basi obtusis vel cuneatis, marginibus integris vel leviter crenatis, costa supra plerumque subplana subtus valde prominente, nervis lateralibus principalibus utrinsecus circiter 10–14, supra subplanis vel subcanaliculatis, subtus elevatis, marginem versus anastomosantibus, venulis immersis vel subprominulis; inflorescentiis terminalibus et axillaribus paniculatis, 3–5 cm. longis 1–2 cm. latis, pedunculo rhachi pedicellisque puberulis, pedicellis teretibus circiter 1.5–3 mm. longis; fructibus rubris (ex coll.) immaturis subglobosis rugosis 1–2 mm. diametro, stylo brevissimo vel nullo, stigmate capitato; carpellis fere 4, sepalis 6–8, anguste lanceolatis circiter 1 mm. longis 0.2–0.3 mm. latis, floribus ceterum ignotis.

HUNAN: Yi Chang District, P'ing T'ou Wan Village, *W. T. Tsang 23719* (US, TYPE; A), May 1–13, 1943 (fairly common on dry sandy soil; shrub, fruit red).

The new species is apparently closely related to *Xanthoxylum alatum* Roxb. from which it differs in its longer leaflets which are oblong to elliptic rather than lanceolate, and in the petiole which is much more narrowly winged. A more important difference is seen in the flowers which commonly bear 4 carpels which have sessile or nearly sessile stigmas. The flowers of *X. alatum* bear only 2 carpels and these have well developed styles.

Xanthoxylum simulans Hance var. **imperforatum** (Franchet) comb. nov.

Xanthoxylum Bungei Planch. var. *imperforatum* Franchet in Mém. Soc. Sci. Nat. Cherbourg **24:** 205. 1884.

Xanthoxylum usitatum Diels in Notes Bot. Gard. Edinburgh **5:** 280. 1912.

Rehder (in Jour. Arnold Arb. 7: 181. 1926) has called attention to the fact that *Xanthoxylum Bungei* Planch. is a nomen nudum and must be replaced by *X. simulans* Hance. He considered, however, that *X. Bungei* var. *imperforatum* was merely a synonym. Our study reveals that two groups may be distinguished here. Our attention was first called to this fact when the junior author, not knowing at the time that *X. Bungei* was invalid, segregated plants into two groups part of which he called *X. Bungei* and the rest *X. simulans*. When it became apparent that

X. Bungei was untenable, a search was made through the literature for a name that might apply to the group of specimens which were like *X. simulans* but differed in a few minor characters. Franchet's var. *imperforatum* seemed to apply and the above transfer is accordingly necessary.

True *X. simulans*, as we understand it, has the leaflets conspicuously dotted and the margins are without glands. The upper surfaces of the leaflets are sometimes scabrous-hispid. Variety *imperforatum*, on the other hand, has the surfaces of the leaflets devoid or nearly devoid of dots and there are prominent glands along the margins of the leaflets in the sinuses of the crenations. Superficially the species and the variety look much alike, but may be readily distinguished by the characters mentioned above.

Xanthoxylum acanthopodium DC. var. **deminutum** (Rehder) comb. nov.

Xanthoxylum dimorphophyllum Hemsl. var. *deminutum* Rehder in Jour. Arnold Arb. **22:** 577. 1941.

SZECHUAN: between Knapi and Tatiaoko, alt. 2600 m. (cited in original description), *C. Schneider 1353* (A); Yen-Yuen District, *infra castellum Kwapi*, vicinity of Otang, alt. 2375 m., *Handel-Mazzetti 482 = 2524* (A).

YUNNAN: Kun-Ming, Tai Pu Chi, Mou Ko Sze, *Y. Tsiang 16493* (type coll. of *X. dimorphophyllum* var. *deminutum*) (photograph and fragment, A).

Although originally described as a variety of *Xanthoxylum dimorphophyllum* it differs from that species in its much smaller, thinner leaves, more compact inflorescences, more slender spines which are present only as stipular pairs, in the densely puberulent twigs, and the smaller fruits. Although Rehder states that the Schneider specimen is in young fruit, re-examination shows that toward the lower part of the specimen there are fruits which are mature and have dehisced. The mature fruits of *X. dimorphophyllum* are 5–6 mm. in diameter, while those of var. *deminutum* are only 3–3.5 mm.

The affinities of this variety are obviously with *X. acanthopodium* which has the same type of compact inflorescence and similar leaves, the latter being thin and having winged petioles. The chief differences are found in the number of leaflets which is predominately 3 in the variety and 5-many in the species, and in the mature fruits which average about 1 mm. smaller in diameter in the variety.

Osborn Botanical Laboratory,
Yale University,
and
University of Nanking,
Nanking, China.

EXPLANATION OF PLATES

PLATE I.

Fagara robiginosa Reeder & Cheo (*H. T. Tsai 62193*) : photograph of type specimen, × ½; drawing of immature fruits, × 5.

PLATE II.

Xanthoxylum arenosum Reeder & Cheo (*W. T. Tsang 23719*) : photograph of type specimen, × ½; drawing of immature fruits, × 5.